

COBALT

(Data in metric tons of cobalt content, unless otherwise noted)

Domestic Production and Use: Domestic mine production ceased at the end of 1971, and the only U.S. cobalt refinery stopped processing imported nickel-cobalt matte in late 1985. Most secondary cobalt is derived from recycled superalloy or cemented carbide scrap and from spent catalysts. About 13 recyclers accounted for nearly all the cobalt recycled in superalloy scrap. There were two producers of extra-fine cobalt powder: One produced powder from imported primary metal and another produced powder from recycled materials. In addition to the powder producers, six companies were known to be active in the production of cobalt compounds. More than 100 industrial consumers were surveyed on a monthly or annual basis. About 85% of U.S. consumption of cobalt was in five major end uses. Superalloys, used mainly in aircraft gas turbine engines, accounted for about 42% of U.S. demand; cemented carbides, paint driers, and magnetic alloys each accounted for about 11%; catalysts about 10%; and other, 15%. The total estimated value of cobalt consumed in 1996 was \$450 million.

Salient Statistics—United States:	1992	1993	1994	1995	1996^e
Production: Mine	—	—	—	—	—
Secondary	1,610	1,570	1,570	1,540	1,500
Imports for consumption	5,760	5,950	6,780	6,440	6,900
Exports	1,420	795	1,360	1,300	1,500
Shipments from Government stockpile excesses	—	289	1,500	1,550	2,000
Consumption:					
Reported (includes secondary)	6,380	6,430	6,990	7,000	7,300
Apparent (includes secondary)	6,590	7,310	8,470	8,660	8,900
Price, average annual spot for cathodes, dollars per pound	22.93	13.79	24.66	29.21	26.00
Stocks, industry, yearend	1,760	1,460	1,490	1,060	1,060
Net import reliance ¹ as a percent of apparent consumption	76	79	81	82	83

Recycling: About 1,500 tons of cobalt was recycled from purchased scrap in 1996. This represented about 20% of estimated reported consumption for the year.

Import Sources (1992-95): Cobalt contained in metal, oxide, and salts: Zambia, 21%; Norway, 19%; Canada, 14%; Finland, 14%; and other, 32%. Since 1991, imports from Zaire and Zambia have decreased, while imports from Finland, Norway, and Russia have increased.

Tariff: Item	Number	Most favored nation (MFN)² 12/31/96	Non-MFN³ 12/31/96
Unwrought cobalt, alloys	8105.10.3000	5.1% ad val.	45% ad val.
Unwrought cobalt, other	8105.10.6000	Free	Free.
Cobalt matte, waste, and scrap	8105.10.9000	Free	Free.
Wrought cobalt and cobalt articles	8105.90.0000	4.8% ad val.	45% ad val.
Chemical compounds:			
Cobalt oxides and hydroxides	2822.00.0000	0.1% ad val.	1.7% ad val.
Cobalt sulfates	2833.29.1000	1.4% ad val.	6.5% ad val.
Cobalt chlorides	2827.34.0000	4.2% ad val.	30% ad val.
Cobalt carbonates	2836.99.1000	4.2% ad val.	30% ad val.
Cobalt acetates	2915.23.0000	4.2% ad val.	30% ad val.
Cobalt ores and concentrates	2605.00.0000	Free	Free.

Depletion Allowance: 22% (Domestic), 14% (Foreign).

Government Stockpile: Sales of National Defense Stockpile cobalt began in March 1993. The Department of Defense's proposed new material disposal authority includes 2,720 tons (6 million pounds) of cobalt during fiscal year 1997 and 2,720 tons (6 million pounds) of cobalt during fiscal year 1998.

Stockpile Status—9-30-96

Material	Uncommitted inventory	Committed inventory	Authorized for disposal	Disposals Jan.-Sept. 96
Cobalt	18,300	655	11,900	903

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Events, Trends, and Issues: World cobalt supply continued to increase. Refinery production in the first half of 1996 was higher than production during the first half of 1995. Cobalt exports from Russia and sales from the National Defense Stockpile also contributed to supply. The free market price for cobalt cathode decreased from approximately \$32 per pound in January to \$20 per pound in July. In August the price began to increase. By the end of September the price was approximately \$23 per pound.

World Mine Production, Reserves, and Reserve Base:

	Mine production		Reserves ⁴	Reserve base ⁴
	<u>1995</u>	<u>1996^e</u>		
United States	—	—	—	860,000
Australia	2,500	2,500	52,000	420,000
Canada	5,270	5,300	45,000	260,000
Cuba	1,560	1,600	1,000,000	1,800,000
New Caledonia ⁵	800	800	230,000	860,000
Philippines	—	—	—	400,000
Russia	3,500	3,500	140,000	230,000
Zaire	1,650	2,500	2,000,000	2,500,000
Zambia	5,000	6,000	360,000	540,000
Other countries	<u>1,810</u>	<u>1,900</u>	<u>90,000</u>	<u>1,200,000</u>
World total (may be rounded)	22,100	24,100	4,000,000	9,000,000

World Resources: The cobalt resources of the United States are estimated to be about 1.3 million tons. Most of these resources are in Minnesota, but other important occurrences are in Alaska, California, Idaho, Missouri, Montana, and Oregon. Although large, most domestic resources are in subeconomic concentrations that will not be economical in the foreseeable future. In addition, with the exception of Idaho, any cobalt production from these deposits would be as a byproduct of another metal. The identified world cobalt resources are about 11 million tons. The vast majority of these resources are in nickel-bearing laterite deposits, with most of the rest occurring in nickel-copper sulfide deposits hosted in mafic and ultramafic rocks in Australia, Canada, and Russia, and in the sedimentary copper deposits of Zaire and Zambia. In addition, millions of tons of hypothetical and speculative cobalt resources exist in manganese nodules and crusts on the ocean floor. Cobalt reserves and reserve base for Australia have been revised to be consistent with data published by the Australian Bureau of Resource Sciences.

Substitutes: Periods of high prices and concern about availability have resulted in various efforts to conserve, reduce, or substitute cobalt. In many applications, further substitution of cobalt would result in a loss in product performance. Potential substitutes include barium or strontium ferrites, neodymium-iron-boron, or nickel-iron alloys in magnets; nickel, cermets, or ceramics in cutting and wear-resistant materials; nickel base alloys or ceramics in jet engines; nickel in petroleum catalysts; rhodium in hydroformulation catalysts; nickel or manganese in batteries; and manganese, iron, cerium, or zirconium in paints.

^eEstimated.

¹Defined as imports - exports + adjustments for Government and industry stock changes.

²No tariff for Canada or Mexico.

³See Appendix B.

⁴See Appendix C for definitions.

⁵Overseas territory of France.